U.S. NUCLEAR REGULATORY COMMISSION

STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

15.4.6 CHEMICAL AND VOLUME CONTROL SYSTEM MALFUNCTION THAT RESULTS IN A DECREASE IN BORON CONCENTRATION IN THE REACTOR COOLANT (PWR)

REVIEW RESPONSIBILITIES

Primary - Reactor Systems Branch ~~(RSB)~~(SRXB)[1]

Secondary - None

I. AREAS OF REVIEW

Unborated water can be added to the reactor coolant system, via the chemical volume and control system (CVCS), to increase core reactivity. This may happen inadvertently, because of operator error or CVCS malfunction, and cause an unwanted increase in reactivity and a decrease in shutdown margin. The operator must stop this unplanned dilution before the shutdown margin is eliminated. Since the sequences of events that may occur depend on plant conditions at the time of the unplanned moderator dilution, the review includes conditions at the time of the unplanned dilution, such as refueling, startup, power operation (automatic control and manual modes), hot standby, and cold shutdown.

The review of postulated moderator dilution events considers causes, initiating events, the sequence of events, the analytical model, the values of parameters used in the analytical model, and predicted consequences of the event.

The sequence of events described in the applicant's safety analysis report (SAR) is reviewed by ~~both~~ [2]the ~~RSB~~SRXB[3]. The ~~RSB~~SRXB[4] reviewer concentrates on the need for the reactor protection system and the operator action required to secure and maintain the reactor in a safe

condition. ~~The RSB review of SRP Section 6.3 covers the systems for emergency injection of borated cooling water.~~[5]

The analytical methods are reviewed by ~~RSB~~SRXB[6] to ascertain whether the mathematical modeling and computer codes have been previously accepted by the staff. If a referenced analytical method has not been previously reviewed, the reviewer initiates a generic evaluation of the new analytical model.

The predicted results of moderator dilution events are reviewed by ~~RSB~~SRXB[7] to assure that the consequences meet the acceptance criteria given in subsection II of this SRP section. Further, the results of the transients are reviewed to ascertain that the values of pertinent system parameters are within ranges expected for the type and class of reactor under review.

Review Interfaces[8]

SRXB also performs the following reviews under the SRP sections indicated:

1. ~~The Core Performance Branch (CPB) r~~Reviews the values of the reactivity parameters used in the analyses as part of its primary review responsibility for SRP Section 4.3 and also performs~~, upon request,~~[9] additional analyses related to ~~these~~ [10]accidents for selected reactor types as part of its primary review responsibility for SRP Sections 4.2 and 4.4.

2. The ~~RSB~~SRXB[11] review of SRP Section 6.3 covers the systems for emergency injection of borated cooling water.

In addition, the ~~RSB~~SRXB[12] will coordinate the other branches' evaluations that interface with the overall review of the system as follows:

1. The Instrumentation ~~and~~& Controls ~~Systems~~ Branch (~~ICSB~~HICB)[13] reviews the instrumentation and control aspects of the sequence described in the SAR to confirm that reactor and plant protection, ~~and safeguards~~engineered safety features (ESF) controls, interlocks, and other instrumentation and control systems important to safety will function as assumed in the safety analysis as part of its primary review responsibility for SRP Sections 7.2 through 7.~~5~~7.[14]

2. The Materials and Chemical Engineering Branch (~~CMEB~~EMCB)[15] reviews the functional and operational characteristics and potential failure modes of the CVCS as part of its primary review responsibility for SRP Section 9.3.4. The ~~RSB~~SRXB[16] reviewer makes use of this review to evaluate initiating causes and the expected sequence of events.

For those areas of review identified above as being reviewed as part of the primary review responsibility ~~of other branches~~under other SRP sections, the acceptance criteria necessary for the review and their methods of application are contained in the referenced SRP ~~s~~Section ~~of the corresponding branch~~.[17]

II. ACCEPTANCE CRITERIA

The ~~RSB~~SRXB[18] acceptance criteria are based on meeting the relevant requirements of the following regulations:

A. General Design Criterion 10 ~~(Ref. 2)~~[19], as it relates to the ~~reactor coolant system being designed with appropriate margin to assure that specified acceptable fuel design limits are not exceeded during normal operations including anticipated operational occurrences~~reactor core and associated coolant, control, and protection systems being designed with appropriate margin to assure that specified acceptable fuel design limits are not exceeded during any condition of normal operation, including the effects of anticipated operational occurrences.[20]

B. General Design Criterion 15 ~~(Ref. 3)~~[21], as it relates to the reactor coolant system and ~~its associated auxiliaries being designed with appropriate margin to assure that the pressure boundary will not be breached during normal operations including anticipated operational occurrences~~associated auxiliary, control, and protection systems being designed with sufficient margin to assure that the design conditions of the reactor coolant pressure boundary (RCPB) are not exceeded during any condition of normal operation, including anticipated operational occurrences[22].

C. General Design Criterion 26 ~~(Ref. 4)~~[23], as it relates to the ~~reliable control of reactivity changes to assure that specified acceptable fuel design limits are not exceeded, including anticipated operational occurrences. This is accomplished by assuring that appropriate margin for malfunctions, such as stuck rods, are accounted for~~control rods being capable of reliably controlling reactivity changes to assure that under conditions of normal operation, including anticipated operational occurrences, and with appropriate margin for malfunctions such as stuck rods, specified acceptable fuel design limits are not exceeded[24].

The general objective of the review of moderator dilution events is to confirm that either of the following conditions are met:

~~1.~~ [25] The consequences of these events are less severe than the consequences of another transient that results in an uncontrolled increase in reactivity and has the same anticipated frequency classification~~.~~, or[26]

~~2.~~ [27] The plant responds to the events in such a way that the criteria regarding fuel damage and system pressure are met and the dilution transient is terminated before the shutdown margin is eliminated.

Specific criteria necessary to meet the relevant requirements of GDC 10, 15, and 26 are as follows:

1. Pressure in the reactor coolant and main steam systems should be maintained below 110% of the design val~~v~~ues[28]. (Ref~~.~~erence ~~1~~4)[29]

2. Fuel cladding integrity shall be maintained by ensuring that the minimum departure from nucleate boiling ratio (DNBR)[30] remains above the 95/95 DNBR limit for PWRs ~~and the CPR remains above the MCPR safety limit for BWRs~~[31] based on acceptable correlations (see SRP Section 4.4).

3. An incident of moderate frequency should not generate a more serious plant condition without other faults occurring independently.

4. An incident of moderate frequency in combination with any single active component failure, or single operator error, shall be considered and is an event for which an estimate of the number of potential fuel failures shall be provided for radiological dose calculations. For such accidents, the number of fuel failures must be assumed for all rods for which the DNBR ~~or CPR~~[32] falls below those values cited above for cladding integrity unless it can be shown, based on an acceptable fuel damage model (see SRP Section 4.2), that fewer failures occur. There shall be no loss of function of any fission product barrier other than the fuel cladding.

5. If operator action is required to terminate the transient, the following minimum time intervals must be available between the time when an alarm announces an unplanned moderator dilution and the time of loss of shutdown margin:

    a. During refueling: 30 minutes.

    b. During startup, cold shutdown, hot standby, and power operation: 15 minutes.

The applicant's analysis of moderator dilution events should be performed using an acceptable analytical model. Should unreviewed analytical methods be proposed, these methods must be evaluated by the staff. For new generic methods, the reviewer initiates an evaluation.

All of the following plant initial conditions should be considered in the analysis: refueling, startup, power operation (automatic control and manual modes), hot standby, and cold shutdown.

The parameters and assumptions used in the analytical model should be suitably conservative. The following values and assumptions are considered acceptable:

(i) For analyses during power operation, the initial power level is rated output (licensed core thermal power) plus an allowance of 2% to account for power-measurement uncertainty.

(ii) The boron dilution is assumed to occur at the maximum possible rate.

(iii) The core burnup and corresponding boron concentration are selected to yield the most limiting combination of moderator temperature coefficient, void coefficient, Doppler coefficient, axial power profile, and radial power distribution. This will usually be the beginning-of-life (BOL) condition.

(iv) All fuel assemblies are installed in the core.

(v) A conservatively low value is assumed for the reactor coolant volume.

(vi) For analyses during refueling, all control rods are withdrawn from the core.

(vii) For analyses during power operation, the minimum shutdown margin allowed by the technical specifications (usually 1%) is assumed to exist prior to the initiation of boron dilution.

(viii) For each event analyzed, a conservatively high reactivity addition rate is assumed taking into account the effect of increasing boron worth with dilution.

(ix) Conservative scram characteristics are assumed, i.e., maximum time delay with the most reactive rod held out of the core.

Technical Rationale[33]

The technical rationale for application of the above acceptance criteria to the analyses of boron dilution events is discussed in the following paragraphs:

1. GDC 10 requires that the reactor core and associated coolant, control, and protection systems be designed with appropriate margin to assure that specified acceptable fuel design limits are not exceeded during any condition of normal operation, including the effects of anticipated operational occurrences. Fuel design limits are established to assure the integrity of fuel cladding as a fission product barrier.

   In PWRs, boron is added to the reactor coolant in sufficient concentrations to effect reactivity control. PWR conditions of normal operation include startup, power operation, hot standby, shutdown (hot and cold), and refueling modes. Because of the frequency with which boron dilution events are anticipated to occur (one or more times during the life of the nuclear power unit) without other concurrent failures or incidents, regulatory requirements associated with anticipated operational occurrences are applied to their analyses/evaluation. Inherent uncertainties associated with quantification or measurement of relevant boron dilution event parameters are verified by analyses to be addressed through inclusion of appropriate design margins.

   Application of GDC 10 thus assures that analyses demonstrate, under all operating, shutdown, and refueling modes, that the reactor core and associated coolant, control, and protection systems are designed with sufficient margins to address postulated boron dilution events, so that fuel cladding integrity will be maintained for such postulated events.

2. GDC 15 requires that the reactor coolant system and associated auxiliary, control, and protection systems be designed with sufficient margin to assure that the design conditions of the RCPB are not exceeded during any condition of normal operation, including anticipated operational occurrences. The design conditions (e.g. pressure limits for

transients) of the RCPB are established to assure its integrity. The RCPB provides a fission product barrier, a confined volume for the inventory of reactor coolant, and flow paths to facilitate core cooling.

In PWRs, boron is added to the reactor coolant in sufficient concentrations to effect reactivity control. PWR conditions of normal operation include startup, power operation, hot standby, shutdown (hot and cold), and refueling modes. Because of the frequency with which boron dilution events are anticipated to occur (one or more times during the life of the nuclear power unit) without other concurrent failures or incidents, regulatory requirements associated with anticipated operational occurrences are applied to their analyses/evaluation.

Reactor coolant system pressure transients attendant to power increases resulting from postulated boron dilution events are analyzed to demonstrate that pressure limiting design features, including conservatively assumed responses of control and protection systems, will maintain pressures below the RCPB design pressure limits for transients. Inherent uncertainties associated with quantification or measurement of relevant boron dilution event parameters are verified by the analyses to be addressed through inclusion of appropriate design margins.

Application of GDC 15 thus assures that analyses demonstrate, under conditions of normal operation, including the effects of postulated boron dilution events, that the reactor coolant system and associated auxiliary, control, and protection systems are designed with sufficient margin so that the integrity of the RCPB will be maintained.

3. GDC 26 requires that the control rods be capable of reliably controlling reactivity changes to assure that under conditions of normal operation, including anticipated operational occurrences, and with appropriate margin for malfunctions such as stuck rods, specified acceptable fuel design limits are not exceeded. Fuel design limits are established to assure the integrity of fuel cladding as a fission product barrier.

In PWRs, a control rod system is provided for reactivity control. Boron is also added to the reactor coolant in sufficient concentrations to effect reactivity control. PWR conditions of normal operation include startup, power operation, hot standby, shutdown (hot and cold), and refueling modes. The control rods may reduce reactivity only when withdrawn and operable (i.e. during startup and power operation), however. Because of the frequency with which boron dilution events are anticipated to occur (one or more times during the life of the nuclear power unit) without other concurrent failures or incidents, regulatory requirements associated with anticipated operational occurrences are applied to their analyses/evaluation. Inherent uncertainties associated with quantification or measurement of relevant boron dilution event parameters are verified by analyses to be addressed through inclusion of appropriate design margins. To address single failures not attributable to a common cause/mode, the control rod system is designed such that a specified minimum shutdown margin exists without credit for the functioning of the highest worth control rod.

Application of GDC 26 thus assures that analyses demonstrate that the control rods are capable of reliably controlling reactivity changes with appropriate margin for malfunctions such as stuck rods, under applicable conditions of normal operation (startup and power operation), including the effects of postulated boron dilution events, such that fuel cladding integrity will be maintained.

III. REVIEW PROCEDURES

The procedures below are used during both the construction permit (CP) and operating license (OL) reviews. During the CP review, the values of system parameters and setpoints used in the analysis will be preliminary in nature and subject to change. At the OL review, final values should be used in the analysis, and the reviewer should compare these to the limiting safety system settings included in the proposed technical specifications.

The descriptions of moderator dilution transients presented in the SAR are reviewed by ~~RSB~~SRXB[34] regarding the occurrences leading to the initiating events. The sequence of events, from initiation until a stabilized condition is reached, is reviewed to ascertain:

1. The extent to which normally operating plant instrumentation and controls are assumed to function. Particularly important are the alarms which alert the operator to the unplanned boron dilution.

2. The extent to which the plant and reactor protection systems are required to function.

3. The credit taken for the functioning of normally operating plant systems.

4. The operation of engineered safety systems that is required.

5. The extent to which operator actions are required.

6. The appropriate margin for malfunctions, such as stuck rods are accounted for.

The ~~RSB~~SRXB[35] reviewer confirms that analyses are included for a boron dilution incident occurring during each of the following plant initial conditions: refueling, startup, power operation (automatic control and manual modes), hot standby, and cold shutdown. The refueling condition should consider cases when the reactor vessel head is removed and the coolant is drained to the elevation of the hot leg piping. For each such incident reviewed, all possible causes must have been considered by the applicant and justification presented that the cause selected for analysis is the one that allows the operator the least time to take corrective action.

With the aid of the ~~EICSB~~HICB[36] reviewer, the timing of the initiation of those protection, engineered safety, and other systems needed to limit the consequences of each boron dilution incident to acceptable levels is reviewed. The ~~RSB~~SRXB[37] reviewer compares the predicted variations of system parameters with various trip and system initiation setpoints. The ~~ICSB~~HICB[38] reviewer evaluates automatic initiation, actuation delays, possible bypass modes, interlocks, and the feasibility of manual operation where the SAR states that operator action is needed or expected.

To the extent deemed necessary, the ~~RSB~~SRXB[39] reviewer evaluates the effects of single active failures of systems and components that may affect the course of the transient.[40] This phase of the review uses the system review procedures described in the standard review plans for Chapters 5, 6, 7, 8, and 9 of the SAR. In particular, the redundancy of alarms that alert the operator to the unplanned dilution is confirmed.

The mathematical models used by the applicant to evaluate core performance and reactivity status are reviewed by ~~RSB~~SRXB[41] to determine if these models have been previously found acceptable by the staff. If not, a generic review of the model proposed by the applicant is initiated.

The values of system parameters and initial core and system conditions used as input to the model are reviewed by ~~RSB~~SRXB[42]. Of particular importance are the reactivity coefficients and control rod worths used by the applicant. The justification provided by the applicant to show that the selected core burnup condition, boron concentration, and rod worths yield the minimum margins is evaluated. ~~CPS is consulted regarding~~ SRXB reviews the values of the reactivity parameters used in the applicant's analysis~~. These values are reviewed by CPB~~ under SRP Section 4.2. The value of core reactivity as a function of time following each incident analyzed is confirmed by comparison with an acceptable analysis performed for another plant, by comparison with staff calculations for typical plants ~~done by CPB on request~~, or by independent calculations by the ~~RSB~~SRXB[43] reviewer.[44]

The assumed dilution flow rates are reviewed, taking into consideration the system parameters which act to limit the flow. The reviewer examines the flow limiting equipment characteristics provided by the applicant to justify ~~his~~[45] flow rate assumptions; e.g., if the flow is limited by the charging pump capacity, the assumed flow is compared with the flow for all charging pumps acting at full capacity. If some lesser value of flow is assumed, such as not all pumps operating, or flow limited by a valve, justification must be provided. ~~EICSB~~HICB[46] is consulted concerning any interlocks for which credit is taken.

The results of the analyses are reviewed and compared to the acceptance criteria presented in subsection II of this SRP regarding the time available for the operator to take corrective action. The variations with time during the transient of important parameters are compared to those predicted for other similar plants to see that they are within the range expected. Parameters of particular importance are core reactivity, boron concentration, rate of addition of unborated water, power level, core pressure, and minimum ~~departure from nucleate boiling ratio (~~DNBR~~)~~[47].[48]

For standard design certification reviews under 10 CFR Part 52, the procedures above should be followed, as modified by the procedures in SRP Section 14.3 (proposed), to verify that the design set forth in the standard safety analysis report, including inspections, tests, analysis, and acceptance criteria (ITAAC), site interface requirements and combined license action items, meet the acceptance criteria given in subsection II. SRP Section 14.3 (proposed) contains procedures for the review of certified design material (CDM) for the standard design, including the site parameters, interface criteria, and ITAAC.[49]

IV. EVALUATION FINDINGS

The reviewer verifies that the SAR contains sufficient information and ~~his~~the[50] review supports the following kinds of statements and conclusions which should be included in the staff's safety evaluation report:

> Various chemical and volume control system (CVCS) malfunctions which could lead to an unplanned boron dilution incident have been reviewed. The malfunctions that allow the operator the shortest time for corrective action have been analyzed starting from plant conditions of startup, power operation (automatic and manual), hot standby, cold shutdown, and refueling. These events were evaluated by the applicant using a mathematical model that has been previously reviewed and found to be suitably conservative. The results of the analyses of these events showed that the operator has __ minutes to take corrective action if a boron dilution incident occurs during refueling and _ _ minutes if at power. In the latter case the most severe transient results in a minimum departure from nucleate boiling ratio (DNBR) of __ and reactor coolant and main steam system pressures of less than 110% of design.
>
> The staff concludes that the analysis for the decrease in reactor coolant boron concentration event is acceptable and meets the requirements of General Design Criteria 10, 15 and 26. This conclusion is based on the following:
>
> 1. The applicant has met the requirements of GDC 10 with respect to demonstrating that the specified acceptable fuel design limits are not exceeded for this event. This requirement has been met since the results of the analysis showed that the thermal margin limits (~~M~~minimum DNBR for PWRs)[51] are satisfied as indicated by SER Section 4.4.
>
> 2. The applicant has met the requirements of GDC 15 with respect to demonstrating that the reactor coolant pressure boundary limits have not been exceeded for this event. This requirement has been met since the analysis showed that the maximum pressure in the reactor coolant and main steam systems did not exceed 110% of the design pressure.
>
> 3. The applicant has met the requirements of GDC 26 with respect to demonstrating that the control rod system has the capability of overcoming the effects of boron dilution events during reactor operation. The applicant has demonstrated the fulfillment of these requirements by showing that under the postulated ~~accident~~operational occurrence[52] conditions, and with appropriate margins for stuck rods, the specified acceptable fuel design limits are not exceeded.

For design certification reviews, the findings will also summarize, to the extent that the review is not discussed in other safety evaluation report sections, the staff's evaluation of inspections, tests, analyses, and acceptance criteria (ITAAC), including design acceptance criteria (DAC), site interface requirements, and combined license action items that are relevant to this SRP Section.[53]

V. IMPLEMENTATION

The following is intended to provide guidance to applicants and licensees regarding the NRC staff's plans for using this SRP Section.

This SRP section will be used by the staff when performing safety evaluations of license applications submitted by applicants pursuant to 10 CFR 50 or 10 CFR 52.[54] Except in those cases in which the applicant proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the method described herein will be used by the staff in its evaluation of conformance with Commission regulations.

The provisions of this SRP section apply to reviews of applications docketed six months or more after the date of issuance of this SRP section.[55]

VI. REFERENCES[56]

~~2~~1. 10 CFR Part 50, Appendix A, ~~GDC~~General Design Criterion 10, "Reactor Design."[57]

~~3~~2. 10 CFR Part 50, Appendix A, ~~GDC~~General Design Criterion 15, "Reactor Coolant System Design."[58]

~~4~~3. 10 CFR Part 50, Appendix A, ~~GDC~~General Design Criterion 26, "Reactivity Control System Redundancy and Capability."[59]

~~1~~4. ASME Boiler and Pressure Vessel Code, Section III, "Nuclear Power Plant Components," Article NB-7000, "~~Protection Against~~ Overpressure Protection[60]," American Society of Mechanical Engineers.

SRP Draft Section 15.4.6
Attachment A - Proposed Changes in Order of Occurrence

Item numbers in the following table correspond to superscript numbers in the redline/strikeout copy of the draft SRP section.

Item	Source	Description
1.	Current PRB names and abbreviations	Editorial change made to reflect the current PRB abbreviation for SRP Section 15.4.6.
2.	Editorial	Deleted "both" to improve grammar since only one review branch is discussed in the sentence.
3.	Current PRB names and abbreviations	Editorial change made to reflect the current PRB abbreviation for SRP Section 15.4.6.
4.	Current PRB names and abbreviations	Editorial change made to reflect the current PRB abbreviation for SRP Section 15.4.6.
5.	Editorial	Relocated this information to Review Interface 2 below.
6.	Current PRB names and abbreviations	Editorial change made to reflect the current PRB abbreviation for SRP Section 15.4.6.
7.	Current PRB names and abbreviations	Editorial change made to reflect the current PRB abbreviation for SRP Section 15.4.6.
8.	SRP-UDP format item, Reformat Areas of Review	Added Review Interface subsection of Areas of Review using numbered paragraphs to be consistent with SRP-UDP required format.
9.	Editorial, Current PRB names and abbreviations	Deleted reference to the CPB since SRXB is now the PRB for the subject reviews. Also deleted "upon request" since SRXB would not need to request that another branch conduct the subject reviews under current PRB assignments.
10.	Editorial	Deleted the word "these" for grammatical improvement since the subject to which "these" refers was unclear in this context.
11.	Current PRB names and abbreviations	Editorial change made to reflect the current PRB abbreviation for SRP Section 15.4.6.
12.	Current PRB names and abbreviations	Editorial change made to reflect the current PRB abbreviation for SRP Section 15.4.6.
13.	Current PRB names and abbreviations	Editorial change made to reflect the current PRB name and abbreviation for SRP Sections 7.2 through 7.7.

Item	Source	Description
14.	Editorial	Added punctuation where needed to improve clarity. Revised description of instrumentation and control aspects of the Review Interface to address ESF (as opposed to "safeguards") controls and other instrumentation important to safety which may be relevant to review of boron dilution events. Added description of the Review Interface for interlocks and other relevant I&C systems important to safety (e.g. CVCS instrumentation/controls) as described in section III, Review Procedures 4th and 8th paragraphs. Also revised to correctly identify the SRP Sections under which instrumentation and controls important to safety are reviewed.
15.	Current PRB names and abbreviations	Editorial change made to reflect the current PRB name and abbreviation for SRP Section 9.3.4.
16.	Current PRB names and abbreviations	Editorial change made to reflect the current PRB abbreviation for SRP Section 15.4.6.
17.	SRP-UDP format item	Revised consistent with SRP-UDP format for Review Interfaces subsection reference to criteria and methods contained in other SRP Sections.
18.	Current PRB names and abbreviations	Editorial change made to reflect the current PRB abbreviation for SRP Section 15.4.6.
19.	SRP-UDP format item	Deleted identification by reference number for GDC citations.
20.	Editorial	Revised to reflect actual wording of GDC 10 requirements.
21.	SRP-UDP format item	Deleted identification by reference number for GDC citations.
22.	Editorial	Revised to reflect actual wording of GDC 15 requirements.
23.	SRP-UDP format item	Deleted identification by reference number for GDC citations.
24.	Editorial	Revised to reflect the actual wording of GDC 26 requirements which are relevant to review of boron dilution events and the specific criteria applied to their review in this SRP section.
25.	Editorial	Replaced numbering with dash/bullet to avoid conflict with numbering subsequently used for specific criteria.
26.	Editorial	Added conjunction to clarify that either of the stated conditions may be applied during the review.
27.	Editorial	Replaced numbering with dash/bullet to avoid conflict with numbering subsequently used for specific criteria.

Item	Source	Description
28.	Editorial	Changed "valves" to "values" to correct typographical error.
29.	SRP-UDP format item.	Format change to make the citation of references consistent with the SRP-UDP format guidance. Also revised reference number to reflect reordering of references in subsection VI.
30.	Editorial	Spelled out the abbreviation DNBR for its first use in this SRP section.
31.	Editorial	This SRP Section is applicable only to PWRs, therefore, criteria stated for BWRs was deleted.
32.	Editorial	This SRP Section is applicable only to PWRs, therefore, criteria stated for BWRs was deleted.
33.	SRP-UDP format item	Technical Rationale were developed and added for the following Acceptance Criteria: GDCs 10, 15, and 26. Technical Rationale is a new SRP-UDP format item.
34.	Current PRB names and abbreviations	Editorial change made to reflect the current PRB abbreviation for SRP Section 15.4.6.
35.	Current PRB names and abbreviations	Editorial change made to reflect the current PRB abbreviation for SRP Section 15.4.6.
36.	Current PRB names and abbreviations	Editorial change made to reflect the current PRB abbreviation for the Instrumentation & Controls Branch.
37.	Current PRB names and abbreviations	Editorial change made to reflect the current PRB abbreviation for SRP Section 15.4.6.
38.	Current PRB names and abbreviations	Editorial change made to reflect the current PRB abbreviation for the Instrumentation & Controls Branch.
39.	Current PRB names and abbreviations	Editorial change made to reflect the current PRB abbreviation for SRP Section 15.4.6.
40.	No change proposed, See Potential Impacts 5298, 5305, 24588, 24589	Although NRC Information Notices generally do not provide sufficient basis for SRP changes under the SRP-UDP, SRXB may wish to emphasize consideration of single failures which could result in degradation or loss of emergency boration capability. Events involving such failures and the potential common-mode failure mechanisms involved are described in Information Notices 82-19, 83-77, 86-63, and 87-57.
41.	Current PRB names and abbreviations	Editorial change made to reflect the current PRB abbreviation for SRP Section 15.4.6.
42.	Current PRB names and abbreviations	Editorial change made to reflect the current PRB abbreviation for SRP Section 15.4.6.

Item	Source	Description
43.	Current PRB names and abbreviations	Editorial change made to reflect the current PRB abbreviation for SRP Section 15.4.6.
44.	Editorial	Revised to reflect that SRXB is the current PRB for SRP section 4.2.
45.	Editorial	Eliminated unnecessary gender specific pronoun.
46.	Current PRB names and abbreviations	Editorial change made to reflect the current PRB abbreviation for the Instrumentation & Controls Branch.
47.	Editorial	Revised to use previously defined DNBR abbreviation for departure from nucleate boiling ratio.
48.	No change proposed, See Potential Impacts 24590 and 24592	Although NRC Information Notices generally do not provide sufficient basis for SRP changes under the SRP-UDP, SRXB may wish to emphasize consideration of the conservatisms necessary for reliable use of flux measurement/flux ratio increases as an indication of boron dilution. Information Notice 91-54 describes new event sequences identified by NRC based upon foreign studies of boron dilution events. Information Notice 93-32 describes nonconservative inputs for boron dilution event analysis of Westinghouse boron dilution mitigation systems.
49.	SRP-UDP Guidance, Implementation of 10 CFR 52	Added standard paragraph to address application of Review Procedures in design certification reviews.
50.	Editorial	Eliminated use of a gender specific pronoun.
51.	Editorial	Revised for consistency with previously defined DNBR abbreviation for departure from nucleate boiling ratio. Where the minimum ratio is discussed, the convention established throughout the SRP Section is to spell out as minimum DNBR.
52.	Editorial-related to SRP-UDP implementation of the resolution of Generic Issue B-3, "Event Categorization"	Replaced "accident" terminology with "operational occurrence" where used to describe/categorize boron dilution events (where coincident single failures are not also postulated). Since the acceptance criteria discussed in this context is GDC 26, which provides design requirements for the performance capability of control rod systems during normal operations and anticipated operational occurrences, it is incorrect to discuss findings related to accidents under a finding of compliance with GDC 26.
53.	Implementation of 10 CFR 52	Standard change made to Evaluation Findings to address design certification reviews.
54.	SRP-UDP Guidance, Implementation of 10 CFR 52	Added standard sentence to address application of the SRP section to reviews of applications filed under 10 CFR Part 52, as well as Part 50.

Item	Source	Description
55.	SRP-UDP Guidance	Added standard paragraph to indicate applicability of this section to reviews of future applications.
56.	SRP-UDP format item	Reordered references to list NRC regulations and documents before documents published by other organizations.
57.	SRP-UDP format item	Spelled out GDC as "General Design Criterion" in references list per SRP-UDP format for reference citations.
58.	SRP-UDP format item	Spelled out GDC as "General Design Criterion" in references list per SRP-UDP format for reference citations.
59.	SRP-UDP format item	Spelled out GDC as "General Design Criterion" in references list per SRP-UDP format for reference citations.
60.	Editorial, Reference Verification	Corrected title of the ASME Boiler and Pressure Vessel Code, Section III, Article NB-7000 based upon the 1992 edition of the Code.

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Integrated Impact No.	Issue	SRP Subsections Affected
	No Integrated Impacts were incorporated in this SRP Section.	